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NON-PHARMACEUTICAL INTERVENTIONS EMPLOYED BY MAJOR AMERICAN CITIES DURING THE 1918–19 INFLUENZA PANDEMIC

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ABSTRACT

A critical question in pandemic influenza planning is the role that nonpharmaceutical interventions (NPI) such as isolation and quarantine, social distancing, and school closure, might play in delaying the temporal impact of a pandemic, reducing the overall and peak attack rate, and reducing the number of cumulative deaths. Such measures could potentially provide valuable time for pandemic-strain vaccine and antiviral medication production and distribution. Optimally, appropriate NPI implementation would decrease the burden on healthcare services and critical infrastructure. These public health measures, however, are often associated with enormous social and economic costs. Therefore, it is imperative to assess past applications of NPIs in order to better understand how they might (or might not) be employed during future pandemics in an effective, legal, ethical manner that inspires confidence and compliance in the public at large.

As such, we explored the historical record of the 1918–19 influenza pandemic in the United States for pertinent mitigation strategies and public health efforts and have designed both quantitative and qualitative analyses in order to explore what constitutes one of the largest databases on the use of nonpharmaceutical interventions to mitigate an easily spread, high mortality and morbidity influenza virus strain (i.e., a category 5 pandemic using the Centers for Disease Control and Prevention February 2007 *Interim Pre-Pandemic Planning Guidance*) (1).

Phase I: Quantititative Analysis of 43 American Cities During the 1918-19 Pandemic

The first phase of this several-year long study in collaboration with the U.S. Centers for Disease Control was recently published in the August 8,

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2008 issue of the *Journal of the American Medical Association* (2). Consequently, let me first describe that study and its results before going on to describe some of the qualitative work we are now designing as we seek to gain a better understanding of the 1918–19 influenza pandemic.

In summary, we studied, quantitatively, the nonpharmaceutical interventions implemented in 43 cities in the continental United States from September 8, 1918, through February 22, 1919, a period that encompasses all of the second pandemic wave (September–December 1918) and the first 2 months of the third wave (January–April 1919). This period coincided with the time span of activation and deactivation of nonpharmaceutical interventions used in these 43 cities. The purpose was to determine whether city-to-city variation in mortality was associated with the timing, duration, and combination (or layering) of nonpharmaceutical interventions; altered population susceptibility associated with prior pandemic waves; age and sex distribution; and population size and density.

What Our Study Is Based Upon: Primary Historical Archival Documents

Mortality data were obtained from the US Census Bureau's *Weekly Health Index* for 1918–1919, a series of reports listing total deaths and death rates for 43 large US cities. These 43 cities numbered among the 66 most populous urban centers according to the 1920 census; all had a population greater than 100,000. Of the 66 most populous cities, the remaining 23 had incomplete archival and mortality records. No city with a comprehensive archival record of nonpharmaceutical interventions was excluded. The *Weekly Health Index* is the most complete extant compilation of weekly pneumonia and influenza mortality data in US urban areas during the 1918–1919 pandemic. Moreover, these cities represented 22% of the U.S. population in 1918–1919 and encompassed a great deal of regional, social, economic, and cultural variation (3).

In addition, we captured all of the available public health documents on nonpharmaceutical interventions implemented by these 43 cities during the 1918–1919 pandemic, including municipal public health department annual and monthly reports and weekly bulletins; every state and federal report on the 1918–1919 influenza pandemic published between 1917 and 1922; US Census pneumonia and influenza mortality data from 1910–1920; the corpus of published historical, medical, and public health literature on the 1918–1919 pandemic; 86 different newspapers from the 43 different cities;

records of US military installations between 1917–1920; and additional holdings housed in several major libraries and archival repositories

Interventions: Nonpharmaceutical interventions were grouped into 3 major categories: school closure; cancellation of public gatherings; and isolation and quarantine. A fourth group, termed "other", which included such difficult to measure NPIs as public health posters, verbal warnings, suggestions to avoid coughing or sneezing on others, wearing face masks, etc. were recorded on our epidemiological histories of the cities but not included in our statistical analysis, because unlike the other three groups, it is impossible to determine when these NPIs were "activated" or "deactivated".

Main Outcome Measures: Weekly excess death rate (EDR); time from the activation of nonpharmaceutical interventions to the first peak EDR; the first peak weekly EDR; and cumulative EDR during the entire 24-week study period.

Results: There were 115, 340 excess pneumonia and influenza deaths (EDR, 500/100,000 population) in the 43 cities during the 24 weeks analyzed. Every city adopted at least 1 of the 3 major categories of nonpharmaceutical interventions. School closure and public gathering bans activated concurrently represented the most common combination implemented in 34 cities (79%); this combination had a median duration of 4 weeks (range, 1–10 weeks) and was significantly associated with reductions in weekly EDR. The cities that implemented nonpharmaceutical interventions earlier had greater delays in reaching peak mortality (Spearman $r = -0.74$, $P < .001$), lower peak mortality rates (Spearman $r = 0.31$, $P = .02$), and lower total mortality (Spearman $r = 0.37$, $P = .008$). There was a statistically significant association between increased duration of nonpharmaceutical interventions and a reduced total mortality burden (Spearman $r = -0.39$, $P = .005$). Using a univariate analysis, no significant statistical associations, positive or negative, were noted between any of the cities' EDR and population, population density, age or gender distribution, or experience during the successive waves.

Conclusions: These findings demonstrate a strong association between early, sustained, and layered application of nonpharmaceutical interventions and mitigating the consequences of the 1918–1919 influenza pandemic in the United States. In planning for future severe influenza pandemics, nonpharmaceutical interventions should be considered for inclusion as companion measures to developing effective vaccines and medications for prophylaxis and treatment (2).

Phase 2 of the Study: The Qualititative Experiences of 43 Major American Cities with the 1918–19 Influenza Pandemic (A Work in Progress)

Our on-going qualititative, historical study seeks to research and analyze the medical, social, and political dynamics of disease mitigation strategies undertaken by urban communities during the 1918–1919 influenza pandemic as a means of informing pandemic policymaking and preparedness planning today.

Specific Aims of the Study:

Our quantitative study of NPIs during the 1918–19 pandemic (2) has convinced us that a critical set of questions remains to be explored, and if systematically investigated, could have a significant impact on pandemic preparedness policy, especially at the local and community level. At the many gatherings of stakeholders where we present our findings, we are always asked by public health practitioners from agencies ranging from the World Health Organization (WHO) to local country health departments, about how the management of the pandemic in a given city was affected by the organization of the local public health system; the relationship of local departments with state, federal, and private agencies and organizations; health campaigns in and attitudes toward immigrant and racial minority groups; and a long list of other contributing economic, social, cultural, religious, and political factors (4–10).

Notably, despite the many excellent studies completed in the last few years on the 1918–1919 influenza pandemic by a wide range of scholars, we still do not know what on-the-ground conditions allowed for some cities to effectively implement NPI, others to bungle or ineffectively implement them, and still others to achieve a mediocre result. We also lack a useful road map for understanding how social, political, and other variables influenced each city's experience and how this might productively inform mitigation efforts today, especially for vulnerable and underprivileged groups. Our ongoing qualitative study will, hopefully, allow us to approach these questions and gain new insight into urban America's experience with the 1918–1919 pandemic (11–18).

Specifically, we hope to examine the NPI strategies and the social experiences of 43 of the most populous U.S. cities during the 1918–1919 pandemic, with the goal of extracting lessons that can inform pandemic preparedness planning in the twenty-first century.

In order to explore systematically the qualitative dimensions of the pandemic in these urban communities, we will anchor our study to the following set of questions related to *social context, authority structure and agency coordination, health profile and history,* and *community compliance.*

1) *Social Context:* How did housing density, socio-economic stratification, age and gender distribution, and political and factors frame each city's experience? What was the experience of immigrant and racial minority groups during the 1918–1919 influenza pandemic? Were some groups scapegoated as disease vectors and what kinds of health risk communication campaigns were undertaken by and in immigrant and minority communities? Broadly, why did some communities demonstrate more social cohesion than others and what lessons might we draw from this aspect of the 1918–1919 influenza pandemic as we seek to attain community cohesion today?
2) *Authority Structure and Agency Coordination:* How was local authority distributed among leading city officials (e.g., the mayor, health commissioner, ward councilor) and how did this organization influence NPI implementation? How did a given city coordinate health efforts with other local (i.e. county), state, federal and private agencies? How transparent or opaque were these relations? Was a particular organizational structure more conducive to the smooth coordination and implementation of NPI and are lessons from this experience relevant today?
3) *Health Profile and History:* How did a city's pre-existing health profile affect its experience with influenza? For example, did cities with high tuberculosis rates or dominated by steel or coal factories or high levels of environmental pollutants fare worse? Are there lessons we can draw from understanding this dimension of the 1918–1919 influenza pandemic today, especially with regard to subpopulations defined by health status (i.e., HIV positive) or neighborhood residence (i.e., living in close proximity to identified environmental contaminants)?
4) *Community Compliance:* Why did some cities' populations comply more readily with public health measures while others protested or ignored such orders? Did particular sub-communities, identified by income, racial or ethnic populations, or other factors, respond more effectively or achieve better outcomes during the 1918–1919 influenza pandemic, and if so, why? Were some public health risk communications more effective than others and what contributed to their efficacy? What conditions help to explain why some communities experienced greater "epidemic fatigue" than others? How can a better understanding of community compliance or defiance during the 1918–1919 influenza pandemic help to inform public health practitioners and policymakers today?

Methods and Research Design

Our scholarly research is guided by rigorous qualitative methods derived primarily from the academic discipline of history and secondarily from the fields of medical sociology, social epidemiology, and health policy. As historians of medicine with a combined 40 years of experience, we are aware of the both the power and limits of historical inquiry. A great deal of its explanatory power stems from the fact that historical inquiry deals with concrete examples of what actually happened to people and environments in the past. Although historical analysis requires interpretation and, hence, a certain measure of abstraction, it is very different from equally valuable methods like predictive mathematical modeling or a statistical analysis. History's great virtue is that it can shed light on the social and human dimensions of the lived experiences of previous generations who faced extraordinary challenges and grappled with quotidian problems that may (or may not) be similar to dilemmas we face in our era. The fact that historical analysis is typically presented as a narrative account enhances its usefulness as a means of educating the public and shaping public policies.

Yet there are limits to historical inquiry. Some of the most salient relate to the difficulty of locating primary source material. In many instances, key documents have been destroyed, misplaced, or simply never stored for posterity's sake. With few exceptions, spotty records are what historians deal with in their inquiries, and much of our knowledge of the past depends on the supporting archival materials that were actually saved. Moreover, some archival materials may not be entirely reliable or may be unavailable, and sometimes even accomplished historians misinterpret the materials, creating more confusion. Many times, lacunae in the historical record are so great that we can only hypothesize or speculate about what may actually have occurred.

For these reasons, it is incumbent on the historian to rigorously obtain all the available primary source material related to the topic at hand and to verify every fact with at least one other reputable source. Only this method will ensure that a historian does not introduce erroneous data points from secondary sources into his or her study and that the most trustworthy data are being employed. In addition, when one studies the history of epidemic disease, a particular set of highly specialized records becomes important. A historian needs to be intimately familiar with the relevant era's collection of epidemiological data, its medical terminology (the same term can mean different things over time), its surveillance and containment methods, and its medical

and microbiological understandings of the cause and spread of the disease.

For example, we hypothesize that even though it implemented only one NPI (isolation and quarantine), New York City fared relatively well in terms of mortality burden during the 1918–1919 influenza pandemic because of its sophisticated long-standing public health department, which was characterized by clear channels of communication. We hypothesize that New Orleans experienced one of the worst outcomes during the influenza pandemic despite implementing a full menu of NPI, partly as a result of the tension among leading city officials such as the health commissioner and mayor and the federal government. Studying Cleveland will allow us to better understand the mechanisms that allowed that Midwestern city to survive the influenza pandemic with a lower mortality rate than many cities in the East Coast. We will explore similar questions for Milwaukee, a city recognized for its activist health department, and for Chicago, where local authorities coordinated effectively with a state level Influenza Board. Chicago, Cleveland, Richmond, Birmingham and New Orleans will serve as rich sites for an analysis of the role of racial dynamics and of the impact of *de facto* and *de jure* racial segregation on community mitigation strategies. We believe that closely examining Seattle and Los Angeles, where the presence of Asian and Mexican immigrant populations created different racial and ethnic dynamics than in the East Coast or the Midwest, will be very illuminating and potentially relevant to diverse urban settings today.

In addition to research travel to these cities we will spend time in Washington, D.C. at the National Archives consulting federal records from the U.S. Public Health Service and the U.S. Army and Navy. Given that the 1918–1919 influenza pandemic erupted during a massive mobilization of troops for World War I and that the military presence often had a great influence on health and society in local communities, we believe it is critical to include an examination of these primary sources in our study. For example, we hypothesize that Chicago's experience of the 1918–1919 influenza pandemic was impacted in substantial ways by the proximity (just 45 miles away) and regular traffic between the city and the Great Lakes Naval Training Station. It will also be important to closely examine the records of the United States Public Health Service to determine how federal health officials interacted with their state and local counterparts during the pandemic (19).

Policy Contributions

The main goals of our study is to generate new and informative historical conclusions about the experience of urban U.S. communities during the 1918–1919 influenza pandemic and to use these to help public health practitioners and policy makers develop pandemic preparedness strategies in the 21st century. We believe that only through a two-pronged approach that includes a general understanding of the experiences of 43 of the most populous U.S. cities and a fine-grained analysis of a subset of illustrative cities and key themes can we begin to understand how the organization of a city's public health department, a mayor's governance style or personality, local racial dynamics, and other social factors shaped a community's experience during the 1918–1919 influenza pandemic. For example, Chicago was one of only three cities that did not implement a school closure during the pandemic. Nevertheless, parents were worried enough to keep their children out of school, leading to an absenteeism rate of approximately 452 (19). We believe that Chicago's experience, especially when compared to cities that implemented one or two phases of school closure and fared similarly in terms of mortality burden, could reveal a great deal about the benefits and drawbacks of compulsory school closure in the advent of 1918-like avian influenza pandemic in the twenty-first century (20–22).

One issue that repeatedly arises in policy discussions about community mitigation is lines of authority and how transparency can be achieved in a time of epidemic crisis (23–26). With regard to this issue, we believe that a historical comparison of cities such as Newark, where the mayor opposed state ordered NPI, and cities such as Milwaukee, where powerful city health officials acted before and then in concert with state authorities could be very illuminating for policy makers today. Finally, one of the areas of the 1918–1919 influenza pandemic that remains unexplored is if it impacted immigrants and racial minorities disproportionately or if such groups were demonized, as was common at the time, as influenza vectors. Moreover, we want to examine the racial and ethnic dimensions of the 1918–1919 influenza pandemic and determine if there are lessons we can derive for today, particularly in terms of the formulation of public health risk communications for diverse urban, multicultural communities.

Even as we recognize the vast differences between the United States in 1918 and 2007 we hope that our findings will be applicable to pandemic preparedness planning today. One of the benefits of launching this project after having already completed two large-scale studies of the 1918–1919 influenza pandemic is that we are acutely aware of

the opportunities for and limits of applying history to contemporary health policy. We also are in regular conversation with bioethicists, health policymakers, and legal scholars, with whom we can share our findings and seek out advice about how best to extrapolate from our historical examples to contemporary policy dilemmas.

Finally, in addition to the health policy audience, we also intend to make our findings accessible to a wider group of generalists and specialists. Towards this end, we will produce a digital archive that is similar to but much more extensive than the on-line resource we have already created at the University of Michigan Center for the History of Medicine (see http://www.med.umich.edu/medschool/chm/influenza) that researchers can access in perpetuity.

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DISCUSSION

DuPont, Houston: Wonderful presentation and very important for pandemic flu preparation. When Brother Bob and I were little kids in Toledo, Ohio, we had scarlet fever and were quarantined in our house. We had a red and black sign on the house. We couldn't leave the house, people couldn't come in. The next 50 years were characterized by, "You got something bad, we'll send you out in the public. No problem. Just send them out". Except for directly observed TB therapy with resistant tuberculosis, there was no

attempt at quarantining. Toronto absolutely handled the SARS epidemic towards the end in the spring of 2003 by quarantining and by using the methods that you have described. So we have had a field test, not just in 1918 but in 2003, that these methods work. Thank you so much for that.

Markel, Ann Arbor: Well thank you. Actually, your observation is a very fascinating historical point. It is an artifact of human history, living in the antibiotic and vaccine era, that we have had such powerful tools against these terrible scourges, which is why I think quarantine and other "old-fashioned" methods really fell by the wayside.

Neilson, Nashville: Listening to the details of how you designed this study, I was wondering whether there weren't any internal control groups for each city. I wonder what the experience was in federal prisons or other large lockup populations during these key intervals when the epidemic was spreading and whether that was the extreme form of quarantine or whether it was a captured population that was ruthlessly slaughtered by the virus.

Markel, Ann Arbor: Those are two excellent questions. To begin with, in terms of an absolute control, no, there wasn't, because every city did something during the 1918 pandemic, although they may have done it late or scattered. What did serve as a de facto control, in over 20 of the cities in our study, were bimodal peaks of mortality. And so if you look at the NPI triggers, when the cities pulled them on, the death rate fell, and when they pulled them off, it starts going back up again, and then again, it starts going back down again when they pulled them on. So the cities are actually serving as their own internal controls during the pandemic. To your second question about what we call "escape communities", and we wrote this up in Emerging Infectious Diseases in December of 2006, we described seven communities that escaped the flu entirely by literally enclosing themselves off before flu ever got to their neck of the woods. One was a naval base in San Francisco Harbor, another was a school for the blind in Pittsburgh. There is a wonderful epidemiological study in Public Health Reports in 1919 on influenza in San Quentin Penitentiary, given your jail question. We found that the escape communities had much greater social control over what they could or could not do compared to the larger cities that we studied, not to mention what modern cities are like today. So we tried to include all of those points in our thought process.

Mackowiak, Baltimore: I enjoyed that, Howard. Thank you. So, St. Louis had a lower peak. The question, however, remains. Can you be confident that the total number of cases were reduced by these interventions or the peak was just delayed and flattened out?

Markel, Ann Arbor: Now that is an excellent question, and I want to quickly go over that, but one of the things that we measure is the area under the curve as the total EDR over the 22 weeks. So St. Louis, as I am looking at it now, is about 358 per 100,000 compared to Philadelphia which is about 748 per 100,000. Statistically, measuring the area under the curve was one of our considerations, absolutely.

Thorner, Charlottesville: That was a wonderful presentation. Obviously in 1918, travel wasn't an issue. So what are going to be the recommendations about air travel if this should ever happen?

Markel, Ann Arbor: That is the million dollar question. By the way, I didn't have enough time, but clearly, 1918 is a different era from the present day. There was travel in terms of train transportation and some automobile, but it is very interesting how people are talking about airline transportation today. In the conversations I have been involved in, I have found that most officials are very hesitant to call for absolute travel bans, perhaps out of concern for economic retaliation by other nations and the demands of the global flow of goods and people. My belief is that if avian flu was discovered to be a human problem, very few people would take the risk of flying. But I think yours is a

very cogent question, particularly in wake of the Andrew Speaker XDR-TB case. The international travel of humans and microbes is something we need to think about very, very carefully.

Duma, Daytona Beach: Very nice subject, however, a very important one too. I wondered in terms of your differences in cities, for example St. Louis and Philadelphia, did you take into account the number of people, the population density per area of living space, since we know it is so important in terms of how widely distributed various homes are as to how successful one situation might have been compared to another. Also, we know that the leadership and the implementation, as you suggested, might be extremely important and what the differences might have been. I think that mortality rate was about 2%. The mortality rate may well be up to 40 or 50% if it the H5N1 strain does get loose, and there you are talking about such a decimation of a population who might be responsible for implementing these things. It might be lost. What are your thoughts about that?

Markel, Ann Arbor: This is an excellent question, and it is a question I get quite a bit. In terms of population density, we did look at both density and population size. In the social historical component, we will be looking more carefully at tenement neighborhoods—for example, immigrant populations, minority groups and so on. But the broader issue that you are describing, about the actual administrative function in these cities, is a critical part of this next study which will not be a paper. It will be a book, and we call it a historical atlas of the flu pandemic. I think it is absolutely critical. I will give an example of Philadelphia. We know there were serious disputes and delays caused by bickering between the city health commissioner, the mayor and the governor of Pennsylvania. Crudely put, there is no question in my mind that these human relationships had an impact. We should also note that Philadelphia also was hit hard by flu very early in the fall and did not have time to react compared to some of the midwestern cities. We also might note the lack of confidence many Philadelphians had for the health department, because of poor performance against a severe polio epidemic in 1916. How do epidemics unfold when the people don't have the trust in the public health authorities and so on. All of these social factors had some impact on the way people complied, and let's face it, compliance is critical in this type of emergency.

Duma, Daytona Beach: And I think right now that many groups, in terms of this preparedness right now, are very upset where their leaderships is going to come from. No one really knows who is going to be directing traffic, so to speak, and many of the local areas and state areas are so left out on a limb wondering about who is going to do all this. Who is going to make these decisions and implement this sort of business?

Markel, Ann Arbor: That is being discussed, but just to tell a funny story, I was at a meeting that was attended by the Secretary of Health and Human Services. At one point, I remarked, "You know it is really a flaw in the Constitution, that public health is often considered a local phenomenon as opposed to a national one." To which the Secretary said, "Professor, there are no flaws in the Constitution". Now in my head, I thought, "Well, it's not the Torah and there are probably a few flaws in there too". But at the meeting I said, "Mr. Secretary, I am a great fan of the Founding Fathers but they wrote that document nearly a century before germ theory was even articulated." There was a great silence in the room, and there was no more discussion on that particular topic. But, levity aside, I think you are absolutely right, and what I am finding, what is being discussed among the stake holders, the state and local offices, the wonderful people of the CDC and the public health service, business communities and so on, there are dialogs going on, and there is work going on, but I

think we have a lot more to do in terms of centralizing this into a national, if not global, effort.

Wolf, Boston: In John Barry's book on the Great Epidemic, he talks about Philadelphia in particular. Apparently the Mayor decided that it would be bad for Philadelphia's image if they admitted how much was going on, and therefore, it wasn't until the epidemic was raging that he did anything. So, in a sense, it was a political decision which delayed the implementation of quarantine or any other NPIs in that community. How do you imagine that if such a new pandemic occurred, we would remove the political decision making from what really is a healthcare issue?

Markel, Ann Arbor: As I just noted, I believe that Philadelphia's response was a bit more complicated than just that particular issue. Nevertheless, it is an important one, failure to admit there is a contagious problem is one of the major *leit motivs* in the history of epidemics. At different points, we see a variety of reasons for such silence, such as the political ramifications of announcing SARS in the Guangdong Province or the cholera pandemic of 1892, particularly in Hamburg, the largest commercial port in the world. As a historian, I rarely indulge in predicting the future. But I would recommend you read the CDC's 2007 Interim guidance planning report. Perhaps the best word in that whole document is the first one - interim. As every clinician who sees patients at the bedside knows, while we may see a patient at 10 a.m. and come to a particular conclusion, that same patient can go sour or something could happen at noon, and we would change our planning and medical treatment. We may have to change things and be very nimble and light-footed if, indeed, we encounter a serious pandemic. We need to have an understanding of what we would do and when we would do it—particularly if we had experienced what the CDC calls a Level 5 pandemic, using hurricane terminology based on mortality rate. So, it is a discussion that is going on. Yes. Is it complete? No, but as I was saying in my concluding remark, this is a remarkable moment in the history of epidemics. We've got a lot of work to do though.

Wolf, Boston: If you are going to suggest that the government admit that it made an initial bad assessment and then change the assessment, I can see why you are having problems with the present administration.

Markel, Ann Arbor: Yes, we are. But it is worth the fight anyway.

Hillis, San Antonio: Do you have information at all about the major European cities?

Markel, Ann Arbor: Yes, we are looking at a little bit of that. You know, there was a wonderful study in The Lancet in December of 2006 looking at impoverished nations in 1918. They found that the poorer the nation, the worse the morbidity and mortality rates were. India was particularly decimated.

Hillis, San Antonio: Could they, in fact, serve as the "control cities".

Markel, Ann Arbor: In my historical judgment, no. Analyzing the historical record becomes very complicated when you are comparing such vastly different places as a modern, medicalized America, circa 1918 to, say, Bombay. As an American historian, I elected to keep the study to the continental United States, even with all the historical problems of applying 90-year-old data to the present. We do need more studies of the developed nations and their major cities. What is encouraging, on the other hand, about these NPIs is that these are things that developing nations could do without a lot of great investment in terms of antivirals or vaccines. So what is very exciting when talking to our colleagues in other countries today is that these are some things that they could actually implement.

Alpert, Tucson: Can you describe the plague epidemic in Oran and the Nobel Prize winning novel in which it takes weeks to get the public heath authorities to recognize and to call what's happening that's killing people on all sides as plague, and then they

start all the quarantines and so forth. So it is the same human qualities that you have been talking about.

Markel, Ann Arbor: You are referring to Albert Camus' *The Plague*, which I teach almost every year, and I am so jealous of Camus, because he is not a doctor; he is not a historian; and he has got it absolutely right. It is a perfectly-written text for understanding an epidemic.